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THE APPLICATION OF INDUSTRIAL WASTEWATER MANAGEMENT AT JAKARTA INDUSTRIAL ESTATE PULO GADUNG

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ABSTRACT

This Paper presents a synthetic review of studies and literature concerning the application of industrial wastewater management at Jakarta Industrial Estate Pulo Gadung Jakarta. Over the past ten years wastewater management has been engaged in industrial communities as a key for environmental management. Nearly 89 % of the total industries in Indonesia are located in Urban areas and discharge their wastewater into the river without any proper treatment. They contributed in increasing pollutans such as BOD, COD, and other contaminants like heavy metals for surface water. Many industries at Jakarta Industrial Estate Pulo Gadung do not have any wastewater treatment plant and although they have one, they are not willing to operate the treatment plant. It is caused by lack in technological and process expertise of wastewater. A technological approach like wastewater minimization and practical solution for various characteristics of industrial waste are presented with some illustrations of different processes treatment removal, land or surface area for environmental management and cost of construction and appurtenances.

INTRODUCTION

Corporate performance is measurable by its activities of which is prooving by way of wastewater treatment. Nearly 89 % on the total industries in Indonesia are located in urban area. Those industries discharges wastewater into the river without any proper primary treatment. As illustration, more than 720 industries are registered in the Brantas River (East Java, situation 2003) and 459 are asses as potential polluter for the rivers. They produced in terms of BOD is 82.7 ton / day and the most important part comes from from paper and pulp industries (42 %). In Jakarta region (JABOTABEK) more than 1740

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medium and lard industries contributed 13 % pollutant in Jakarta – Ciliwung River with level of degradation (recorded in 2002) by decreases of PH of surface water by 0.13 / year increase in BOD by 3.24 ppm /year and also increase in COD and other contaminant like Fe, Cd, Zn, and others. The establihment of clean river Program (PROKASIH) , in short term, subjected to control puntual pollution source. Since than the Government policy has not yet been effective to improve the water quality in a substantial way, although water quality standard have been formulated for surface water and industrial effluents by the Decrease to State Minister of Population and Environment No. 12/MENKLH/I/1988 and No. 03/MENKLH/II/1991.

Some Industries has been built years ago when the river water pollution had not yet become serious problem, so they did not realize the necessity of installing a wastewater treatment plant. Some of the small scale industries are not capable enough to finance the construction of treatment plant as well as the opperation and maintenance. Many people, including some industrialist, do not aware their contribution in the water quality deterioration. Many industries do not have any wastewater treatment plant and althoug they have one, they are not willing to operate the treatment plant continuously. It is also caused by lack in wastewater treatment and process expert particularly in planning (designing), operation and maintenance of wastewater tratment plant.

MATERIALS & METHODS

2.1 How to Minimize Waste in Industrial Management?

An general, the first step in minimizing the effects of Industrial waste on receiving streams and treatment plants is to reduce the volume of such wastes. This may be accomplished by (1) classification of wastes; (2) conservation of wastewater; (3) changing production to decrease wastes; (4) reusing both industrial and domestic effluents as raw water supplies.

2.1.1 Classification of Wastes

If waste are classified so that manufacturing process waters are separated from cooling waters, the volume of water requiring intensive treatment may be reduced considerably. Sometimes it is possible to classity and separate the process wastes themselves, so that only the most poluted one are tread and the relatively uncontaminated are discharge without treatment. The three main classes of waste are treatment. The tree main classes as waste are :

- Waste from manufacturing processes
- Waste used as rolling agents in industrial processes
- Waste from sanitary uses in industry

2.1.2 Conservation of Wastewater

Water conserves is waste saved. Conservation begins when an industry changes from an open to a clossed system. For example a paper mill which recycles white water (water passing through a wire screen upon which paper is formed) and this reduces the volume of waste waters it uses is practicing water consevation.

2.1.3 Changing Production to Decrease Wastes

This is an effective method of controlling the volume of wastes but is difficult to put into practice. Waste treatment at the source should be considerated an integral part of production. If the process engineer argues that it would cost the company money to change its methods of manufacture in order to reduce pollution at the source, the environmental engineer can do more than simply enter a plea for the improvement og mankind's environment.

2.1.4 Reusing Both Industrial and Domestic Effluents for a Water Supplies

Reusing and conserving water is the term to achieve *"Gerakan Hemat Air"* declared by the President of the Republik of Indonesia this Month. This method would be practical for industries as so many other users (municipals, commercials etc.) In Industry the greatest use for water is for cooling purposes. Since the volume of this water requirement is usually great, industry should consider reusing the effluents.

RESULTS AND DISCUSSION

The results obtained for comparison of pollution loads between industrial waste and domestic sewage are shown in Table I.

Table – 1: *General Comparison of Pollution Loads in Industrial Wastes Versus Domestic Sewage*

ORIGIN OF WASTE	Biochemical Oxygen Demand (BOD)	Suspended Solid
Domestic Sewage	1	1
Paper Mill waste	16 – 1330	6100
Tannery waste	24 – 48	40 – 80
Textile-Mill Waste	0.4 – 360	130 – 580
Cannery Waste	8 – 800	3440

***** *Persons per unit of daily production at Jakarta Industrial Estate Pulo Gadung*

(a) Biochemical Oxygen Demand (BOD) is usually exerted by dissolved and colloidal organic matter and imposes a load on the biological units of the treatment plant. Oxygen must be provided so that bacteria can grow and oxidize the organic waste, requires more bacterial activity more oxygen, and greater biological unit capacity for its treatment. This calls for an increase in both capital Outlay and daily operating expense.

(b) Suspended solids are found in considerable qualities in many industrial wastes, such as cannery and paper mill effluents. They are screened and / orsettled out of the sewage at the disposal plant. Solids removed by settling and separated from the flowing sewage are called sludge, which may then undergo an anaerobic decomposition known as digestion and be pumped out to drying beds or vacum filters for extraction of additional water. Suspended solids in industrial waste may settle more rapidly or slowly than sewage suspended matter. If industrial solids settle faster than those of municipal sewage, sludge should be removed at shortee intervals to prevent excessive build up. Quantities of stale sludge may

"scoured" off the bottom of the basin with resultant increase of sludge in the effluent..

3.1 Management in Operation, Processes, and Concept

The contaminants in wastewater are removed by physical, chemical and biological means. The individual methods usually are classified as physical unit operations, chemical unit processes, and biological unit processes. These operations and processes occur in a variety of combinations in management system.

3.1.1 Physical Unit Operations

Management methods in which the application of physical forces predominale are known as physical unit operation. Because most of these methods evolved directly from mans first observations of nature, they were the first to be used for wastewater management. Screening, mixing, flocculation, sedimentation, flotation, and filtration, are typical unit operations.

3.1.2 Chemical Unit Processes

Management methods in which the removal or conversion of contaminants is brought about by the addition of chemicals or by other chemical reactions are known as chemical unit processes. Precipitation, management is accomplished by producing a chemical precipitate that will settle. In most cases, the settled precipitate will contain both the constituents that were swept out of the wastewater as the precipitate settles. Adsorption involves the removal of specific compounds from the wastewater on solid surfaces using the forces of attraction between bodies.

3.1.3 Biological Unit Processes

Management methods in which the removal of contaminants is brought about by biological activity are known as biological unit processes. Biological treatment is used primarily to remove the biodegradable organic substantces (colloidal or dissolved) in wastewater. Basically these substances are converted into gases that can escape to the atmosphare and into bilogical cell tissue that can be removed by settling. Biological management is also used to remove the nitrogen in wastewater. With proper environmental control, wastewater can be managed biologically in most cases. Therefore, it is the responsibility of the engineer to ensure that the proper environment is produced and effectively controlled.

Most of the unit operations and processes used for wastewater treatment are undergoing continual and intensive investigation from the standpoin of implementation and application. As a result, mary modifications and new operations and processes have been developed and implemented more need to be made to meet the increasingly stringent requirements for environmental enhancement of water courses.

3.2 The Application of Treatment Methods in Industrial Wastewater Management

The principal methods used for the treatment of wastewater and sludge are identified in this section. Detailed descriptions of each method are not presented becoused

the purposed here is only to introduce the many different ways in which treatment can be accomplihed.

Wastewater processing noted in Paragraph 3.1., that unit operations and processes are grouped together to provide what is as primary, secondary, and tertiary (or advanced) treatment. The term primary refers to physical unit operation, secondary refer to chemical and biological unit processes, and tertiary refers to combinations of all three. It should be noted that these terms are arbitrary and in most cases of little value. A more rationalapproach is first to establish the degree of contaminant removel (treatment) required before the wastewater can be reused or discharged to the environment. The required operations and processes necessary to achieve that required degree of treatment can that be grouped together on the basis of fundamental considerations.

The contaminants of major interest in wastewater and the unit operations and processes or methods applicable to the removal of these contaminants are shown in Table 2. Secondary treatment as defined by the US Environmental Protection Agency is directed principally toward the removal of biodegradable organic and suspended solids.

3.3 Sludge Processing

Fort the most part, the methods and systems reported in Table 3 arewe used to treat the liqid portion of the wastewater. Of equal if not of more impotance in the over all design of treatment facilities are the corresponding unit operations and processes or systems used to process the sludge removed from the liquid portion of the wastewater. The principal methods now in use are reported in Table 3.

Table – 2: *Unit Operation, Unit Processes and Treatment System Used to Remove the Contaminants Found in Wastewater*

Contaminants	Unit Operation, Process, Treatment
Suspended Solids	Sendimentation Screening and comminution Filtration Variations Flotation Chemical-polymer addition Coagulation / Sendimentation Land treatment
Biodegradable organics Activated Sludge Variations	Fixed Film : trickling filters Fixed-film : Rotating biological contactors Lagoon variations Intermittent Sand Filtration Land treatment Systems Physical-chemical systems
Pathogens	Chlorination Hypochlorination Ozonation Land treatment systems

Nutrients: Nitrogen	Suspended growth nitrification and denitrification variations Fixed film nitrification and denitrification variations Ammonia Stripping Ion exchange Break point chlorination Land treatment systems
Phosphorus	Metal salt addition Lime Coagulation Biological chemical phosporus removel Land treatment systems
Heavy Metals	Chemical precipitation Ion exchange Land treatment systems
Refractory Organics	Carbon adsorption Tertiary ozonization Land treatment systems
Dissolved Inorganigs solid	Ion exchange Reverse osmosts Electrodiallysis

***** *Adapted from (Metcalf & Eddy, 1991)*

Tabel – 3: *Sludge Processing and Disposal Methods*

Processing Disposal Function	**Unit Operation, Process or Treatment**
Preliminary Operations	Sludge pumping and Grinding Sludge blending and storage
Thickening	Gravity Thickening Flotation thickening Centrifugation Classification
Stabilization	Chlorine Oxidation Lime Stabilization Anaerobic Digestion Aerobic Digestion Pure-oxygen aerobic Digestion Heat Treatment
Conditioning	Chemical Conditioning Elutriation
Dewatering	Centrifuge Vacum filter Pressure filter Horizontal-belt filter

	Drying bed Lagoon
Drying	Dryer
Composting	Composting Co-composting
Thermal	Multiple hearth incineration Flash Combution Co-incinaration Co-pyrolysis Pyrolysis Wet-air Oxidation Recalcination
Ultimat Disposal	Landfill Land application
Reuse	

***** *Adapted in part from (Met Calf & Eddy, 1991)*

CONCLUSIONS

At the Present time, Management in Operation and Processes are grouped together to provide what is known as primary, secondary, and tertiary (or advanced) as follows :

1. Physical operations, such as screening and sedimentation, are used in cases floating and settleable solids found in wastewater.
2. Biological and Chemical processes are used to remove most of organic matter.
3. Additional combination of unit operations and processes are used to remove other constituents, such as nitrogen and phosphorus, which are not removed by secondary treatment.
4. Hand treatment processes combine physical, chemical, and biological treatment mechanisms and produce water with a quality similar to that from advanced wastewater treatment.
5. Gewnetic engineering has the potential to make industrial wastewater management more efficient and economical by minimizing the need for pretreatment adjustment.
6. Few attempts have considered the physical and chemical characteristic of wastewater to be managed as an applied technology is still large at Jakarta industrial estate Pulo Gadung.

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